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B.TECH. (AEROSPACE ENGINEERING) (BTAE)

00054

Term-End Examination

June, 2014

BAS-022 : COMPOSITE MATERIALS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer **any seven** questions. **All** questions carry **equal** marks. **Use** of scientific calculator is **permitted**.*

1. (a) State briefly the types and general characteristics of ceramics and glasses. **5+5**
   (b) Explain briefly 'Metal - matrix composites'.

2. (a) What are the advantages of ceramic materials ? List the applications of ceramics. **5+5**
   (b) Determine the Young's modulus of a composite containing 65% (by volume) of glass fibre ($E_f = 70$ GN $/m^2$) in a matrix of epoxy resin ($E_m = 3$ GN$/m^2$) under isostress condition.

3. (a) Explain in brief the 'structure of crystalline ceramics'. Also discuss various types of silicate structure. **5+5**
   (b) Describe in brief the constituents of glass. Also list the properties of glass.

4. (a) State the requirements which a commercial glass must meet. **5+5**
   (b) Explain briefly 'Processing of ceramics.

5. (a) Discuss in brief the production of composite structure. 5+5

(b) What are the different forms of polymer chains ? Give examples of each form.

6. (a) Compare thermoplastics and thermosets, considering their structure physical and mechanical properties. 5+5

(b) Why are material fibers much stronger than the bulk form ? Explain using typical examples.

7. (a) Why are carbon /carbon composites used and what are their main applications ? 5+5

(b) What are the functions and applications of laminated glass ?

8. (a) Discuss the general characteristics of the fabrication processes for composite materials. 5+5

(b) A unidirectional Kevlar-49 fiber - epoxy composite contains 60 percent by volume of Kevlar - 49 fibers and 40 percent epoxy resin. The density of the Kevlar - 49 fibers is 1.48 Mg/m^3 and that of the epoxy resin is 1.20 Mg/m^3

(i) What are the weight percentages of Kevlar - 49 and epoxy resin in the composite material, and

(ii) What is the average density of the composite ?

9. Calculate : 10

(a) the modulus of elasticity,

(b) the tensile strength and

(c) the fraction of the load carried by the fiber for the following composite material stressed under isostrain condition the composite consists of a continuous glass - fiber - reinforced - epoxy resin produced by using 60 percent by volume of E - glass fibers having a modulus of elasticity of

$E_f = 72$ GPa and a tensile strength of 2400 MPa and a hardened epoxy resin with a modulus of $E_m = 3$ GPa and a tensile strength of 62 MPa.

10. (a) It is generally true that fibers are stronger (in the length direction) than the bulk material from which they are made. Can you explain why ? 5+5

(b) Define Non - Destructive Testing (NDT). What are the benefits of NDT ? Describe in brief Ultrasonic NDT.